云 南 植 物 研 究 1993; **15** (2): 179—190
**Acta Botanica Yunnanica**

# 云南五种毛茛科植物的核形态研究兼论星果草属和鸡爪草属的系统位置*

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**摘要** 本文对产于云南的 5 种毛茛科植物进行了核形态研究。升麻(*Cimicifuga foetida* L.) 的静止核和有丝分裂前期染色体分别属于复杂中央染色微粒型和中间型，中期染色体大，核型公式为 $2n = 16 = 10m + 4sm + 2st$；滇川翠雀花 ( *Delphinium delavayi* Franch. ) 染色体较大，核型公式为 $2n = 16 = 4m + 6sm + 6st$；星果草 ( *Asteropyrum peltatum* (Franch.) Drumm. et Hutch.) 的静止核和分裂前期染色体分别为复杂中央染色微粒型和中间型，中期染色体较大，为 R 型，核型公式为 $2n = 16 = 10m + 4sm + 2st$；云南黄连 ( *Coptis teeta* Wall. ) 的静止核为简单中央染色微粒型和复杂中央染色微粒型的过渡类型，分裂前期染色体为近基型和中间型的过渡类型，中期染色体较小，为 C 型，核型公式为 $2n = 18 = 14m+4sm$；粉背叶人字果(*Dichocarpum hypoglaucum* W. T. Wang et Hsiao ) 的静止核和前期染色体分别属于简单中央染色微粒型和近基型，中期染色体很小，豆状，T 型，数目为 $2n = 24$。其中星果草的核型、粉背叶人字果的染色体数目、滇川翠雀花和云南黄连的染色体数目和核型为首次报道。本文还指出了张芝玉认为鸡爪草属 (*Calathodes*) 的染色体属于 T 型的观点是错误的。鸡爪草属的染色体属于 R 型。根据上述结果并结合有关资料，本文重点讨论了星果草属和鸡爪草属的系统位置，认为星果草属与黄连属和人字果属都有较远的关系，它可能是金莲花亚科 (*Helleboroideae*) 中的成员；鸡爪草属与金莲花属关系密切，将它另立成族和转移到唐松草亚科 (*Thalictriodeae*) 中都是不适宜的。

**关键词** 毛茛科；升麻；滇川翠雀花；星果草；云南黄连；粉背叶人字果；鸡爪草属；核形态；系统位置

# A KARYOMORPHOLOGICAL STUDY OF FIVE SPECIES IN THE RANUNCULACEAE FROM YUNNAN, WITH A SPECIAL CONSIDERATION ON SYSTEMATIC POSITIONS OF ASTEROPYRUM AND CALATHODES

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*受国家自然科学基金和中国科学院生物分类区系学特别支持费部分资助。

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1992–01–03 收稿，1992–10–05 修回

**Abstract** In the present paper, five species in the Ranunculaceae from Yunnan were karyomorphologically investigated. Based on the results, along with the data in comparative morphology and palynology etc., systematic positions of *Asteropyrum* and *Calathodes* were discussed.

**Key words** Ranunculaceae; *Cimicifuga foetida; Delphinium delavayi; Asteropyrum peltatum; Coptis teeta; Dichocarpum hypo–glaucum; Calathodes;* Karyomorphology; Systematic position

# INTRODUCTION

The Ranuncualceae, comprising about 50 genera and 2000 species, are distributed worldwide, mainly in the temperate and frigid–temperate zones of northern hemisphere. Approximately 42 genera and 700 species are found in China [1] .

Numerous cytological contributions have been made to the systematics of the Ranunculaceae. Langlet [2] noticed that the chromosomes in the Ranunculaceae fell into two sharply and markedly different types based on both size and curvature of the chromosomes. One type he described as predominantly large, always long and bent and called it the *Ranunculus*–type (R–type). The second type he described as small and bean–shaped and called it the *Thalictrum*–type(T–Type).Based on this feature he divided the Ranunculaceae into two subfamilies, i.e. *Ranunculoideae* with R–type chromosomes and *Thalictroideae* with T–type ones. Gregory [3] followed Langlet and accepted the distinction of R–and T–type chromosomes in this family. Futhermore, he recognized the chromosomes of *Coptis* and *Xanthorhiza* as another type. i.e. C–type, and put these two genera together in *Coptideae*. Recently, Okada and Tamura [4] made a karyomorphological observation in 33 species of 16 genera of the Ranunculaceae (including *Paeonia* and *Glaucidum*) . They found the distinction between R– and T–type is not always clear as far as the chromosome length of size is concerned. For example. *Ranunculus* is a typical genus with R–type chromosomes, but in some polyploid species, such as *R. sceleratus* and *R. nipponicus*,the chromosomes are considerably small and not so different from those of *Dichocarpum* and *Aquilegia* with Ttype chromosomes, at least in size or length. Besides chromosome size, however, they revealed that both chromosome types are still distinguishable by karyomorphological characteristics of the resting nuclei and mitotic prophase chromomsomes. In the resting nuclei of R–type, numerous darkly stained condensed bodies can be observed, but their boundaries are not clear, because the other part is also stained fairly well and unevenly. While in those of T–type, several condensed bodies can be clearly observed, because the other part isstaind only dilutely and evenly. In the prophase chromosomes of R–type, heterochromatic segments are distributed throughout the length of chromosomes and the boundaries between hetero– and euchromatic segments are indistinct. While in those of T–type, heterochromatic segments are in the proximal part of arms, and the boundaries between hetero–and euchromatic segments are distinct. As a result of these cytological and other morphological studies, Tamura [5] stressed that the chromosome feature is the most important character in the phylogenetical consideration of the Ranunculaceae.

In the present paper, five species in the Ranunculaceae from Yunnan were karyomorphologically investigated . Based on the results, along with the data in comparative morphology and palynology etc., systematic positions of *Asteropyrum* and *Calathodes* were discussed.

## MATERIALS AND METHODS

The localities and sources of five species studied are tabulated in Table 1. The voucher specimens are deposited in the herbarium of Kunming Institute of Botany, Academia Sinica (KUN).

Table 1 The Origin of materials

| Taxon | Locality | Voucher specimen |
|---|---|---|
| Cimicifuga foetida | Zhongdian County | Fang Zhen–dong 1528 |
| Delphinium delavayi | Songming County | Gong Xun 9015 |
| Asteropyrum peltatum | Gongshan County | Zhang Qi–tai 012 |
| Coptis teeta | Gongshan Coounty | Zhang Qi–tai 019 |
| Dichocarpum hypoglaucum | Malipo County | Wu Quan–an 89068 |

For the observations of somatic chromosomes, the growing root tips utilized were pretreated in 0.1% colchicine at about 20℃ for three hours, and then were fixed in acetic alcohol (1:3 = glacial acetic acid : ethanol) at 5℃ for 30 minutes. They were macerated in 1:1 mixture of mol / L hydrochloric acid and 45% acetic acid at 60℃ for two minutes and then were stained and squashed in 1% aceto–orcein before observation.

Karyomorphological classification of resting nuclei and mitotic prophase chromosomes followed Tanaka [6—7]. Karyotype analysis followed Levan et al [8] and karyotype classification followed Stebbins [9].

## RESULTS

### 1. Cimicifuga foetida L.

In the resting nuclei ( Fig. 1: A), 20—40 darkly stained heteropycnotic bodies, which are termed chromocenters, were observed. In addition to these chromocenters, there occured many chromomeres located in other regions of the nucleus. Thus, karyomorphology of the resting nuclei of this species was of the characteristics of R–type chromosomes and could be categorized to be the complex chromocenter type if according to Tanaka's classification.

In the prophase chromosomes (Fig. 1:B), eu– and heterochromatic segments were distinguishable, but boundaries of both segments were indistinct, and the transition was gradual. The heterochromatic segments were distributed in the proximal regions as well as distal and intestital regions of both arms . Thus, Karyomorphology of the chromosomes at mitotic prophase was of the interstitial type.

In the mitotic metaphase cell, the chromosomes were counted to be 2n = 16 (Fig.1:C,D; Fig.2:A), ranging in length from 12.37–6.87μm and belonging to typical R–type. The karyotype could be formulated as 2n = 10m+4sm+2st(Table 2), belonging to Stebbins' 2A type. This species was found to be diploid in Europe [2,10] as in Yunnan, but two cytotypes, i.e. diploid with karyotype formula of 2n = 16 = 8v+6J+2I and tetraploid with karyotype formula of 2n = 32 = 20V+8J+ 4I, were reported from the Himalayas by Emura [11—12].

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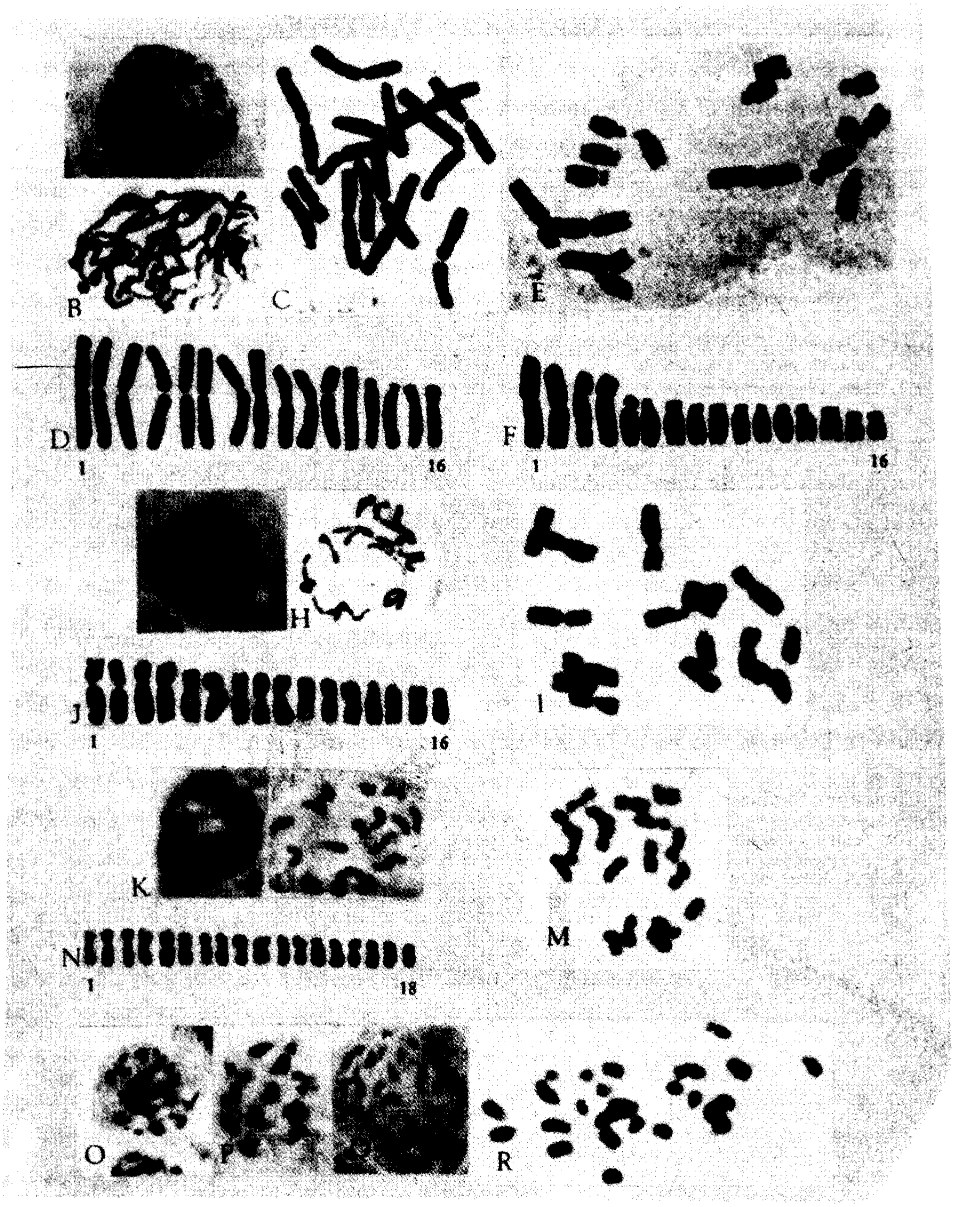

Fig. 1 Photomicrographs of chromosomes in five species of Ranunculaceae.

1. *cimicfuga foetida* L. ：A. resting stage( × 767)；B. prophase ( × 727)；C, D. metaphase ( × 1240). 2. *Delphinium delavayi* Franch. ：E, F. metaphase ( × 1354). 3. *Asteropyrum peltatum* (Franch.) Drumm. et Hutch. ：G. resting stage ( × 960)；H. prophase ( × 840)；I, J. metaphase ( × 1767). 4. *Coptis teeta* Wall. ：K. resting stage ( × 1767)；L. prophase ( × 1094)；M, N. metaphase ( × 1767)；5. *Dichocarpum hypolaucum* W.T. Wang et Hsiao ：O, P. resting stage ( × 974; 1714)；Q. prophase ( × 960)；R. metaphsse( × 1767).

$2n=16=8V+6J+2I$ and tetraploid with karyotype formula of $2n=32=20V+8J+4I$, were reported from the Himalayas by Emura [11—12]。

### 2. Delphinium delavayi Franch.

This species is endemic to China, distributed widely in Yunnan and southwest of Sichuan.

The metaphase chromosomes were counted to be 2n = 16 (Fig.1:E,F;Fig.2:B) ranging in length from 9.16–2.85 μm and belonging to typical R–type. The karyotype formula was 2n = 4m+6sm+6st (Table 2). The karyotype, belonging to Stebbins′ 3B type, was most asymmtrical and bimodal. The chromosome number and karyotype of this species were reported for the first time.

### 3. Asteropyrum peltatum (Franch.) Drumm. et Hutch.

Table 2 The parameters of chromosomes of *Cimicifuga foetida* and *Delphinium delavayi*

| *Chromosome* | *Cimicifuga fietida*<br>2n = 16 = 10m+2sm+4st | | | *Delphinium delavayi*<br>2n = 16 = 4m+6sm+6st | | |
|---|---|---|---|---|---|---|
| No | RL | AR | PC | RL | AR | PC |
| 1 | 15.68 | 1.14 | m | 22.19 | 1.17 | m |
| 2 | 15.05 | 1.12 | m | 18.25 | 2.15 | sm |
| 3 | 14.57 | 1.07 | m | 12.21 | 3.13 | st |
| 4 | 13.31 | 1.39 | m | 10.73 | 3.14 | st |
| 5 | 11.77 | 1.09 | m | 11.09 | 3.74 | st |
| 6 | 11.22 | 1.93 | sm | 9.62 | 2.71 | sm |
| 7 | 9.68 | 5.63 | st | 9.01 | 2.17 | sm |
| 8 | 8.71 | 2.12 | sm | 6.90 | 1.55 | m |

RL = Relative length; AR = Arm ratio; PC = Position of centermoere

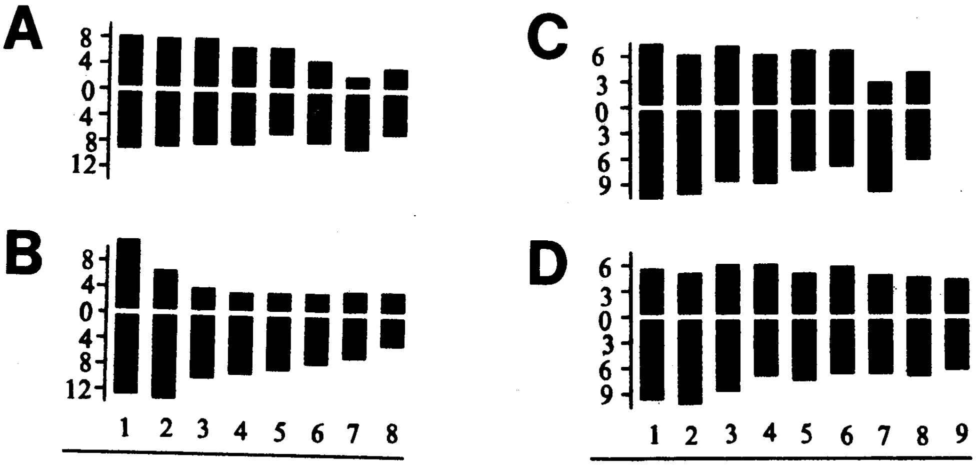

Fig. 2 Haploid karyotype idiograms of 4 species in Ranunculaceae.
A. *Cimicifuga foetida* L.; B. *Delphinium delavayi* Franch. ; C. *Asteropyrum peltatum* (Franch.)Drum. et Hutch.; D. *Coptis teeta* Wall.

This species was formerly reported to occur only in the central and southwestern parts of China [1], but recently it was also found inBhutan [13].

Karyomorphology of the resting nuclei (Fig.1:G) and the chromosomes at mitotic prophase (Fig.1:H) of this species was similar to that in *Cimicifuga foetida;* the former was categorized to be the complex chromocenter type and the latter the interstitial type.

The metaphase chromosomes were counted to be 2n=16 (Fig.1,J;Fig.2:C), confirming the counting reported by Zhang [14] , but the chromosomes observed here were fairly large, ranging in length from 4.79–2.60 μm and belonging to R–type, which is not in accord with Zhang′s observation that this species had very small T–type chromosomes. The karyomorphological characteristics of the resting nuclei and mitotic prophase chromosomes also showed that the metaphase chromosmes of this species should be classified as R–type. The karyotype could be formulated as 2n=10m+4sm+2st (Table 3), belonging to Stebbins′ 2A type, and was reported for the first time.

It is worthy to mention here that Zhang [14] made a same unfortunate error in her observation of chromosomes of *Calathodes oxycarpa*. She regarded its chromosomes as T–type, but from the plate in her paper, it can be seen that the chromosomes are rather large and should belong to R–type. In fact, it is early in 1965 that Kurita [15] had studied the chromosomes of *Calathodes polycarpa* from Taiwan, and compared its karyotype with that of Trollius, which has typical R–type chromosomes. He did not find any decided difference in their karyotypes. Obviously Zhang neglected Kurita′s work, resulting in her and Fu′s [16] unreasonable treatment of *Calathodes*,a originally well established member of *Helleboroideae–Trollieae,* as will be discussed below.

### 4. Coptis teeta Wall.

This species is distributed in the northwest of Yunnan and southeast of Xizang (Tibet) as well as in the northern Burma.

In the resting nuclei (Fig.1:K), several darkly stained heteropycnotic bodies were observed. Chromatin surrounding condensed bodies was gradually diffused, and the boundary of the bodies was rather indistinct. In the prophase chromosomes (Fig.1:L), the heterochromatic segments were mainly distributed in proximal regions of both arms, but appeared also in distal and interstitial regons. Thus, karyomorphology of resting nuclei of this species was the intermediate between the simple chromocenter type and complex chromocenter type; and that of the mitotic prophase chromosomes was the intermediate between the proximal type and interstitial type.

Table 3 The parameters of chromosomes of *Asteropyrum peltatum* and *Coptis teeta*

| Chromosome | *Asteropyrum peltatum*<br>2n=16=12m+2sm+2st | | | *Coptis teeta*<br>2n=18=14m+4sm | | |
|---|---|---|---|---|---|---|
| No | RL | AR | PC | RL | AR | PC |
| 1 | 15.82 | 1.46 | m | 13.26 | 1.76 | sm |
| 2 | 14.32 | 1.73 | sm | 13.25 | 2.10 | sm |
| 3 | 12.94 | 1.46 | m | 12.82 | 1.41 | m |
| 4 | 13.75 | 1.20 | m | 11.16 | 1.10 | m |
| 5 | 12.07 | 1.14 | m | 10.72 | 1.51 | m |
| 6 | 11.63 | 1.04 | m | 10.72 | 1.16 | m |
| 7 | 10.89 | 4.11 | st | 9.77 | 1.38 | m |
| 8 | 8.57 | 1.54 | m | 9.59 | 1.56 | m |
| 9 | | | | 8.71 | 1.44 | m |

See table 2 for the explanation

The metaphase chromosomes (Fig.1:M,N; Fig.2:D),ranging in length from 2.94—1.63$\mu$m, were smaller than the R-type ones but obviously larger than the T-type ones. It seems to be somewhat reasonable that Gregoory [3] classified the chromosomes of *Coptis* as C-type. The karyotype could be formulated as 2n = 18 = 14m+4sm (Table 3), belonging to Stebbins′ 2A type. The chromosome number and karyotype were given here for the first time.

**5. Dichocarpum hypoglaucum W. T. Wang et Hsiao**

In the resting nuclei (Fig.1:O,P), 5—16 darkly stained heteropycnotic bodies, which were unregularly protruded, were clearly observed. The other region was just very dilutely stained, so the boundary of the bodies was rather distinct. Karyomorphology of the resting nuclei was categorized to be simple chromocenter type. In the prophase chromosomes (Fig.1;Q), heterochromatic segments were concentrated in proximal regions of both arms. Thus, karyomorphology of the chromosomes at mitotic prophase was of the proximal type.

The metaphase chromosomes (Fig.1:R), counted to be 2n = 4x [17] = 24 and ranging in length from 2.26—0.75 $\mu$m, were very small and beanshaped, and belonged to typical T-type. The chromosome number of this species was presented for the first time.

## DISCUSSION

Based on the above results, along with the data in comparative morphology and palynology etc., the systematic postitions of *Asteropyrum* and *Calathodes* were discussed.

**1. Systematic position of Asteropyrum**

*Asteropyrum,* including only two species, i.e. *A. peltatum* and *A.cavalerei,* was separated from *Isopyrum* by Drummond and Hutchinson [18] in 1920. This genus was generally considered to be closely related to *Dichocarpum* [19], particularly to *Coptis* [20] based on the more or less resemblance of their petals, phytochemical compounds and aperture types of pollen grains until Zhang [14] revealed the distinct differences between *Asteropyrum* and *Coptis* in their chromosome types and basic numbers. She considered that *Asteropyrum* had T-type chromosomes with x = 8, while *Coptis* had C-type chromosomes with x = 9. Based on this feature she and W. T. Wang separated it from *Coptideae* to establish a new tribe,i.e. *Asteropyreae*. Tamura and Kosuge [21] as well as Fu [16] basically followed them but the former two authors reduced it to a subtribe of *Coptideae,* implying that they still believed that both genera might have some relationships.

It should be said that Zhang made some important contributions to the elucidation of the systematic position of *Asteropyrum* to have first emphasized its distant relation with *Coptis,* but the error made by her in the observation of chromosomes of this genus, as mentioned already above, made her and the other authors [16,21] still place this genus in *Thalictroideae* (s.l.) or *Isopyroideae* (s.s.). The present study has shown that *Asteropyrum* has R-type chromosomes with x = 8, instead of T-type as reported by Zhang, while *Coptis* has C-type with x = 9, and *Dichocarpum* has T-type with x = 6. Thus, cytologically, these three genera are considerably different.

In fact, besides the differneces in chromosome features, the three genera are also remarkably distinct in other important characters such as carpel structure, leaf shape, type of perforation plates of vessel elements and embryological development. In *Asteropyrum*, leaves are simple and peltate, and carpels are 5—8 in number, free, estipitate, perfectly closed; in *Coptis*. leaves are 3—5–divided or 1–3 times ternately compound, and carpels are 5—14 in number, free, stipitate, not perfectly closed;in *Dichocarpum*, leaves are pedately compound. and carpels are constantly 2 in number, connate at the base and perfectly closed. According to Chen and Li [22] , *Asteropyrum* is unique in the Ranunculaceae with that all of its vesselelements possess typical scalariform perforation plates with over 30 transverse bars. In other genera of this family, the vessel elements were only partly provided with this type of perforation plates, some of which showed much fewer bars. Formerly, it was commonly considered that only in *Paeonia* the vessel elements had scalariform perforation plates [23] , which, as is well known, was even one of the important characters to isolate *Paeonia* from Ranunculaceae to establish Paeoniaceae [24] . Chen and Li's studies showed that the perforation plate type of vessel elements in *Asteropyrum* with over 30 bars might be more primitive than that in *Paeonia* with fewer bars. Sun and Wang [25] reported that the ovules of *Asteropyrum peltatum* have two integuments and is pseudo–crassinucellate; they pointed out that such ovule type seemingly has never been so far observed in other genera of this family.

It can not be denied that there do exist more or less similarities in their petals and aperture types of pollen grains in *Asteropyrum, Coptis* and *Dichocarpum*. The problem is that they do not necessarily indicate that these three genera have close relationship, because such similarities resulted most propably from the convergent evolution. In the Ranunculaceae, the petal is considered to be derived from the stamen and to have appeared sporadically and independently in various groups [5] , thus it is imaginable that the convergent evolution of petals might have readily occured. In fact, same petal patterns often occur in phylogenetically distant groups of the Ranunculaceae. In this family, therefore, the petal characters had better only be used for the classification at or below generic level. That is to say, in some well established tribes, such as *Ranunculeae* and *Isopyreae* [16] , the petal might be an important character to trace the course of the evolution, but it is dangerous to overestimate the significance of petal characters in the phylogenetical consideration of this family. Janchen [26] so emphasized the importance of petal characters in his systematic arrangement of the Ranunculaceae that he placed *Cimicifuginae, Helleborinae* and *Isopyrinae* togther in *Isopyreae*, and *Thalictrinae, Anemoninae, Clematidinae* and *Kingdoniinae* together in *Clematideae*. From the present viewpoint, Janchen's system of the Ranunculaceae seems to be quite unnatural. As regards to the aperture types of pollen grains, convergent evolution appears more often to have taken place in this family. For example. *Anemone* [27] , *Clematis* [28] , *Pulsatilla* [29] and *Ranunculus* [30] have tricolpate, pantocolpate and pantoporate pollen grains, as well as their inter–mediate types; even in the same species, two types can be observed. In tribe *Trollieae*, tricolpate pollen grains are predominantly common, but in Caltha, pantoporate pollen grains can be also occasionally observed [31] . Concretely speaking, in the three genera under discussion here, *Asteropyrum* has pantocolapate and pantoporate pollen [16] , and *Coptis* has only pantoporate pollen [14,16,31] , while most species of *Dichocarpum* have tricolpate pollen except two hexaploid species, i.e *D. stoloniferum* and *D. hakonense* [17] , which are endemic to Japan, having pantoporate pollen [16] . Thus, palynologically, *Dichocrpum* seems to be more primitive than *Asteropyrum* and *Coptis*, but cytologically and morphologically, this genus might be more advanced with all its species being polyploids [17,32] (tetraploids or hexaploids) and the carpels being constantly 2 in number and connate at the base. Such poor correlation of characters makes one easily reflect that their similarity in pollen type might be superficial and actually can not suggest their true relationship.

The resmblance of their phytochemical compounds, i.e., that magnoflorineand benzylisoquinoline types of alkaloids are distributed in *Asteropyrum* as well as *Coptis* and *Dichocarpum* [33—34] , might be another case. Since these two types of alkloids are widespread not only in various groups of Ranunculaceae, such as *Trollieae, Delphineae, Isopyreae* and *Thalictreae,* but also in other groups of *Magnoliidae,* this character might just be a so–called sympleisomorphy of these three genera and are uninformative in the consideration of their phylogeny.

Based on the above analyses, it can be concluded that *Asteropyrum* might be phylogenetically rather distant from *Coptis* and *Dichocarpum*. This genus, with R–type chromosomes of x = 8 and multiseeded follicles, might find its best position in *Helleboroideae* if considering the chromosome feature and carpel morphology are the most important characters for the division of subfamilies in the Ranunculaceae. Practically, when Drummond and Hutchinson [18] in 1920established this genus, they had proposed that it might be better put in the neighbourhood of *Caltha* and *Trollius,* In 1923, Hutchinson [35] formally arranged it, together with *Trolllius, Calatha, Calathodes* and *Helleborus etc., in Helleboroideae—Helleboreae—Calthinae.* It is regretful that the later authors did not pay serious attention to his arrangemnt. Of course, from the present viewpoint, *Asteropyrum* seems not o be so close to *Caltha* and *Trollius* by having stalked petals as well as unique simple peltate leaves and vessel elements with scalariform perforation plates. Most interestingly, preserved in this genus are not only some primitive features, but also some advanced ones, such as stalked petals and pantocolpate or pantoporate pollen grains. In phytogeography, this small genus, including only two species, is distributed in Sino–Himalayan region, mainly in the southwestern mountainous areas of China. From these respects, it can be postulated that *Asteropyrum* might be a relict group in the Ranunculaceae, and might have undergone a long history of development since its origin. Probably this is also the reason why this genus is morphologically so isolated from other groups that it is diffcult to determine eventually its systematic position. It can not be decided yet here whether to treat it as a separate tribe of *Helleboroideae* or a subtribe of *Trollieae*. After more careful and detailed studies of the characters of this genus, we believe that a cladistic analysis might shed some light on this problem.

**2.Systematic position of Calathodes**

*Calathodes* is originally a relatively well established genus in systematic position. It is usually thought to be most closely related to *Trollius*. Prantl [36] even treated it as a section of *Trollius*. Tamura [37] considered that it might be more closely related to *Megaleranthis* Ohwi, a monotypic genus endemic to South Korea, than to *Trollius* based on their resemblance in follicles, but actually *Megaleranthis* is also one of the near allies of *Trollius*. Ohwi himself did not recognized this genus after he had published it only for two years [38,39] , and Ohwi's treatment was recently supported by palynological evidence provided by Lee [40,41] .

As mentioned in our observation, Zhang [14] in 1982 made an error in her examination of the chromosomes of *Calathodes* to misunderstand its chromosomes as T–type, and more unfortunately, she was also mistaken to regard the tricolpate pollen grains with striate exines in *Calathodes* to be unique in *Helleboroideae*. Based on these two so–called diagnostic characteristics, she separated this genus from

*Trollieae* to establish a new tribe,i.e. *Calathodeae*, but still placed it in *Helleboroideae*. Fu [16] recognized this new tribe and transfered it without no hesitation to *Thalictroideae* as its most primitive member based on the view that T–type chromosomes are one of the most stable and important characters in this subfamily, thus resulting in an essential change of the systematic position of this genus.

In fact, the chromosomes of *Calathodes* belong to R–type, and are morphologically very similar to those of *Trollius* as reported by Kurita [15]. He, following Prantl, regarded that *Calathodes* might be congeneric with *Trollius* from a cytotaxonomical viewpoint. In palynology, the pollen grains of *Trollius* have been repeatedly observed to be of striate exines [28,30,31,40,41]. Thus it can be claimed that *Trollius, Calathodes* and *Megaleranthis* do share the essentially same pollen grain type. Since such pollen grain type has never been so far found in other groups of Ranunculaceae, this character strongly suggests that these three genera be really most closely allied to each other and even probably be congeneric. It is, therefore, unacceptable that Zhang isolated *Calathodes* from *Trollieae* to establish a separate tribe, let alone that Fu transferred it to *Thalictroideae*.

**Acknowledgements** This work is part of the postdoctoral research project of the first author at Laboratory of Systematic and Evolutionary Botany, Institute of Botany, Academia Sinica. The authors would like to express their sincere thanks to Prof. Hong De–yuan for his guidance, support, and encouragement, and to Mr. Fang Zheng–dong from Institute of Ecology and Geobotany, Yunnan University, Messrs. Zhang Qi–tai, Lu Ren–fu, Lu Yuan–xue from Kunming Institute of Botany, Academia Sinica, for providing them research materials. Many thanks also go to Messrs. Fu De–zi, Wang Xiao–quan and Qing Hai–ning from Institute of Botany, Academia Sinica,for their valuable suggestions. The first author is also grateful to Dr. Lee Sangtae from Sung Kyun Kwan University, Korea, for sending him some papers.

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# 江西杜鹃花属一新变种

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# A NEW VARIETY OF RHODODENDRON FROM JIANGXI

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**白花映山红** (新变种)

**Rhododendron simsii** Planch. var. **albiflorum** R.L.Liu, var. nov.

A type differt corollis albis, intus viridimaculatis; filamentis et stylis omnibus albis; stylis basi versus complanato-strigosis albis.

**Jiangxi:** Jinggang Mountain Mt. alt. 250 m, in shrubbery, April 10, 1992, Wang Xiaoling 9202(type, flower), 9203, both are conserved in Herbarium of Jinggang Mountain Nature Reservation.

与原种(*Rh. simsii* Planch.)的区别在于花冠、花丝、花柱均为白色, 花冠内的斑点绿色; 花柱基部被白色平扁的糙伏毛。

**江西:** 井岗山, 灌丛中, 海拔 250 m, 1992 年 4 月 10 日, 王小林 9202, 9203, 模式标本存井岗山自然保护区标本室。

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1992-04-27 收稿